CHAPTER 1. INTRODUCTION

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This technical support document (TSD) is a stand-alone report that provides the technical analyses and results in support of the information presented in the final rule for establishing energy conservation standards for residential dishwashers, dehumidifiers, cooking products and commercial clothes washers (also referred to as "the considered products").

1.2 OVERVIEW OF STANDARDS FOR RESIDENTIAL DISHWASHERS, DEHUMIDIFIERS, AND COOKING PRODUCTS AND COMMERCIAL CLOTHES WASHERS

The Energy Policy and Conservation Act (EPCA) of 1975 (42 U.S.C. 6291–6309) established an energy conservation program for major household appliances. The National Energy Conservation Policy Act of 1978 (NECPA) amended EPCA to add Part C of Title III (42 U.S.C. 6311–6317), which established an energy conservation program for certain industrial equipment. Additional amendments to EPCA have given the Department of Energy (DOE) the authority to regulate the energy efficiency of several products, including residential dishwashers, dehumidifiers, and cooking products and commercial clothes washers—the products that are the focus of this document. The amendments to EPCA in the National Appliance Energy Conservation Act of 1987 (NAECA) established prescriptive energy conservation standards for dishwashers and cooking products, as well as requirements for determining whether these standards should be amended. (42 U.S.C. 6291–6309) The amendments to EPCA in the Energy Policy Act of 2005 (EPACT 2005), P.L. 109-58, included provisions that expanded DOE's energy conservation program to include certain residential products and commercial equipment, including dehumidifiers and commercial clothes washers.

NAECA established prescriptive standards for gas cooking products, requiring gas ranges and ovens with an electrical supply cord not to be equipped with constant burning pilots, and directed DOE to conduct two cycles of rulemakings to determine if more stringent standards are justified.[a] (42 U.S.C. 6295(h)(1)–(2)) DOE initially analyzed standards for cooking products as part of an eight-product standards rulemaking. It issued a notice of proposed rulemaking (NOPR) on March 4, 1994, proposing performance standards for gas and electric residential cooking products, including microwave ovens. 59 FR 10464. In accordance with the July 15, 1996, *Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products* (the "Process Rule"), 61 FR 36974 (July 15, 1996), DOE refined its standards analysis of cooking products. With regard to gas cooking products, DOE focused on

[a] DOE is required to conduct two cycles of rulemakings for both gas and electric cooking products.

the economic justification for eliminating standing pilots. Partially due to the difficulty of conclusively demonstrating that elimination of standing pilots was economically justified, DOE issued a final rule on September 8, 1998, that covered only electric cooking products, including microwave ovens. 63 FR 48038. The final rule found that no standards were justified for electric cooking products. DOE never completed its standards rulemaking for gas cooking products.

NAECA also established prescriptive standards for dishwashers, requiring that they be equipped with an option to dry without heat, and further required that DOE conduct two cycles of rulemakings to determine if more stringent standards are justified. (42 U.S.C. 6295(g)(1), (4), (5)) On May 14, 1991, DOE issued a final rule establishing the first set of performance standards for dishwashers; the new standards became effective on May 14, 1994. 56 FR 22250. DOE initiated a second standards rulemaking for dishwashers by issuing an advance notice of proposed rulemaking (ANOPR) on November 14, 1994. 59 FR 56423. As a result of the priority-setting process outlined in the Process Rule, DOE suspended the standards rulemaking for dishwashers. The Energy Independence and Security Act of 2007 (EISA 2007; Pub. L. No. 110-140) amended EPCA to establish revised energy conservation standards for residential dishwashers. (42 U.S.C. 6295(g)(9)) These EISA 2007 amendments set energy efficiency standards for these products, effective January 1, 2010; therefore, DOE is not adopting standards for residential dishwashers in this final rule and instead will codify these statutory standards in a separate final rule.

Dehumidifiers are products first covered by EPACT 2005, which established standards for these products with an effective date of October 1, 2007. (Section 135(c)(4)) EPACT 2005 also required that DOE issue a final rule by October 1, 2009, to determine whether these standards should be amended. If amended standards were justified, EPACT 2005 required them to become effective by October 1, 2012. In the event that DOE failed to publish a final rule by October 1, 2009, EPACT 2005 specified a new set of amended standards with an effective date of October 1, 2012. EISA 2007 amended EPCA to establish revised energy conservation standards for dehumidifiers, effective October 1, 2012. (42 U.S.C. 6295(cc)) As with dishwashers, DOE is not adopting standards for dehumidifiers in this final rule and instead will codify these statutory standards in a separate final rule.

Like dehumidifiers, commercial clothes washers are equipment first covered by EPACT 2005. EPACT 2005 established standards for commercial clothes washers with an effective date of January 1, 2007. (Section 136(e)) EPACT 2005 also requires that DOE issue a final rule by January 1, 2010, to determine whether these standards should be amended.

1.3 PROCESS FOR SETTING ENERGY CONERVATION STANDARDS

Under EPCA, when DOE evaluates new or amended standards, it must consider, to the greatest extent practicable, the following seven factors (42 U.S.C. 6295(o)(2)(B)(i); 42 U.S.C. 6316(a)):

1) the economic impact of the standard on the manufacturers and on the consumers of the products subject to such a standard;

2) the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increases in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard;

3) the total projected amount of energy, or as applicable, water, savings likely to result directly from the imposition of the standard;

4) any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard;

5) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;

6) the need for national energy and water conservation; and

7) other factors the Secretary considers relevant.

Other statutory requirements are set forth in 42 U.S.C. 6295(o)(1)–(2)(A), (2)(B)(ii)–(iii), (3)–(4) and 42 U.S.C. 6316(a).

DOE considers stakeholder participation to be a very important part of the process for setting energy conservation standards. DOE actively encourages the participation and interaction of all stakeholders during the comment period in each stage of the rulemaking. Beginning with the framework document and during subsequent comment periods, interactions among stakeholders provide a balanced discussion of the information that is required for the standards rulemaking.

In conducting energy conservation standards rulemakings, DOE involves stakeholders through formal public notifications (*i.e.*, *Federal Register* notices). For this rulemaking, DOE employed the procedures set forth in the Process Rule to the extent they were appropriate for developing energy conservation standards for the considered products. The Process Rule greatly enhances opportunities for public input and improved analytic approaches, and encourages adoption of consensus-based standards. The Process Rule provides policies and guidelines for early public review and consultation with interested parties with regard to identifying and screening design options, selecting a proposed standard, and establishing the final standard. The factors for screening design options include: (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on product utility or product availability; and (4) adverse impacts on health or safety (Process Rule at section 4(a)(4)). 61 FR 36982.

The Process Rule requires DOE to evaluate uncertainty and variability through the use of scenario or probability analysis, and provides for review by experts and interested parties of the analyses used, including: (1) qualitative and quantitative analytical methods; (2) economic, engineering, and life-cycle cost (LCC) analyses; and (3) impacts on manufacturers and consumers, national energy savings, the economy, and the environment. Although the Process Rule specifically applies only to the development of energy conservation standards for consumer products, DOE has decided to apply its procedures to the development of energy conservation standards for commercial and industrial equipment as well. See appendix A to subpart C of Title 10 of the Code of Federal Regulations Part 430 (10 CFR Part 430).

Before DOE determines whether or not to adopt a proposed energy conservation standard, it must first solicit comments on the proposed standard. (42 U.S.C. 6295(o)(2)(B)(i)) Any new or amended standard must be designed to achieve significant additional conservation of energy and be technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) To determine whether economic justification exists, DOE must review comments on the proposal and determine that the benefits of the proposed standard exceed its burdens to the greatest extent practicable, weighing the seven factors listed above. (42 U.S.C. 6295(o)(2)(B)(i))

After the publication of the framework document, the standards rulemaking process involves three additional formal, major public notices, which DOE publishes in the Federal Register. The first of the rulemaking notices is an ANOPR[b], which is designed to publicly vet the models and tools used in the rulemaking, and to facilitate public participation before the proposed rule stage. The second notice is a NOPR, which presents a discussion of comments received in response to the ANOPR; analysis of the impacts of standards on consumers, manufacturers, and the nation; DOE's weighting of these impacts; and the proposed standards. The third notice is the final rule, which presents a discussion of comments received in response to the NOPR; the revised analysis of the impacts of standards; DOE's weighting of these impacts; the standards DOE is adopting; and the effective dates of the standards.

In April, 2006, DOE published a *Rulemaking Framework for Commercial Clothes Washers and Residential Dishwashers, Dehumidifiers, and Cooking Products*, describing the procedural and analytical approaches DOE anticipated using to evaluate the establishment of energy conservation standards for these products. This document is available at www.eere.energy.gov/buildings/appliance_standards/. DOE held a public meeting on April 27, 2006, to discuss procedural and analytical approaches to the rulemaking, and to inform and facilitate interested parties' involvement in the rulemaking process. The analytical framework presented at the public meeting described different analyses, such as the engineering analysis and

[b] In energy conservation standards rulemakings in the past, and for this rulemaking, DOE issued an ANOPR following publication of the framework document. The Energy Independence and Security Act of 2007 eliminated the requirement that DOE issue ANOPRs as part of the standards rulemaking process; see EISA 2007, at sec. 307. DOE is now using an alternative process known as the preliminary activities and analyses. The preliminary activities and analyses will provide the same information and ability for public comment as the ANOPR, but without publication of analyses in the *Federal Register*.

the LCC and payback period (PBP) analysis, the methods proposed for conducting them, and the relationships among the various analyses. Table 1.3.1 lists the analyses undertaken and reported in each of the formal public rulemaking documents.

Table 1.3.1 Analyses Under the Process Rule

ANOPR	NOPR	Final Rule
Market and technology assessment	Revised ANOPR analyses	Revised analyses
Screening analysis	Life-cycle cost sub-group analysis	
Engineering analysis	Manufacturer impact analysis	
Energy and water use determination	Utility impact analysis	
Markups for equipment price determination	Environmental assessment	
Life-cycle cost and payback period analysis	Employment impact analysis	
Shipments analysis	Regulatory impact analysis	
National impact analysis		
Preliminary manufacturer impact analysis		

During the April, 2006, public meeting, interested parties commented about the following issues related to the rulemaking: (1) the existing DOE test procedure for microwave ovens; (2) baseline unit definitions for the considered products; (3) number of product classes for the considered products; (4) consideration of limiting standby power as a design option for all considered products; (5) technology options for improving efficiency for all considered products; (6) type of approach to employ for the engineering analysis; (6) efficiency levels to consider for all of the considered products; (7) implications of clothes container volume on commercial clothes washer efficiency; (8) proposed approaches for specifying typical annual energy and water consumption for all considered products; (9) potential data sources for characterizing variability in annual energy and water consumption; (10) typical distribution channels and markups for the considered products; (11) data sources for retail prices; (12) type of approach to employ for the LCC and PBP analyses; (13) variability of forecasted energy and water prices; (14) repair, maintenance, and installation cost relationship to product efficiency; (15) product lifetimes; (16) development of consumer discount rates; (17) purchase price impacts on product shipments; (18) forecasted saturation rates of commercial clothes washers; (19) consumer subgroups; (20) water and wastewater utility impacts; and (21) wastewater discharge impacts. Interested parties' comments submitted during the Framework Document comment period elaborated on the issues raised at the public meeting. DOE worked with its contractors to address these issues in the analyses.

After the April, 2006, public meeting, as part of the information gathering and sharing process, DOE organized and held interviews with manufacturers of the considered products.

DOE selected companies that represented production of all types of equipment, ranging from small to large manufacturers, and included both Association of Home Appliance Manufacturers (AHAM) member companies and non-AHAM member companies. DOE had four objectives for these interviews: (1) Solicit feedback on the draft engineering analysis (including methodology, production costs, manufacturing processes, and findings); (2) solicit feedback on topics related to the preliminary manufacturer impact analysis (MIA); (3) provide an opportunity, early in the rulemaking process, to express specific concerns to DOE; and (4) foster cooperation between the manufacturers and DOE. There were six general topics related to the preliminary manufacturer impact analysis discussed during each of the interviews: (1) general key issues; (2) shipment projections; (3) capital conversion costs; (4) product mix and profitability; (5) market shares and industry consolidation; and (6) cumulative regulatory burden. DOE incorporated the information gathered at the interviews into its engineering analysis (see chapter 5 of the ANOPR TSD) and the preliminary manufacturer impact analysis (see chapter 13 of the ANOPR TSD). Following the publication of the ANOPR and the ANOPR public meeting, DOE held additional meetings with manufacturers as part of the consultative process for the MIA conducted during the NOPR phase of the rulemaking.

DOE developed spreadsheets for the LCC, PBP, and national impact analyses for each of the considered products in an effort to meet the objectives of the Process Rule. For each product, DOE developed an LCC spreadsheet that calculates the LCC and PBP at various energy efficiency levels. DOE also developed a national impact analysis (NIA) spreadsheet that calculates the national energy savings (NES) and national net present values (NPVs) at various energy efficiency levels. This spreadsheet includes a model that forecasts the impacts of energy efficiency standards at various levels on product shipments. All of these spreadsheets are available on the DOE website (www.eere.energy.gov/buildings/appliance_standards), within the specific pages for each of the considered products.

On November 15, 2007, DOE published an ANOPR to consider establishing new or revised energy conservation standards for the covered products, and to announce a public meeting to receive comments on a variety of issues. 72 FR 64432. This document is available at www.eere.energy.gov/buildings/appliance_standards/. DOE held a public meeting on December 13, 2007, to provide interested parties the opportunity to comment on topics including: (1) the proposed product classes; (2) the analytical framework, models, and tools (*e.g.*, LCC and NES spreadsheets) that DOE used to perform analyses of the impacts of energy conservation standards; (3) the results of the preliminary analyses; and (4) the candidate energy conservation standard levels.

After the publication of the ANOPR and the presentation of the ANOPR to interested parties at the public meeting, DOE conducted interviews with manufacturers of the covered products as part of the MIA for the NOPR. There were thirteen general topics discussed during each of the interviews: (1) general key issues; (2) company overview and organizational characteristics; (3) company financial parameters; (4) production cost breakdown; (5) shipment projections and market shares; (6) equipment mixes; (7) conversion costs; (8) markups and profitability; (9) cumulative regulatory burden; (10) exports, foreign competition, and

outsourcing; (11) direct employment impact assessment; (12) market consolidation; and (13) baseline products and different design options.

Subsequent to the ANOPR, DOE revised its preliminary analyses to address public comments it had received on its ANOPR. In addition, DOE conducted all of the analyses identified in Table 1.3.1 that are required for the NOPR phase of the rulemaking.

On October 17, 2008, DOE published a NOPR proposing energy conservation standards for the covered products, and to announce a public meeting to receive comments on a variety of issues. 73 FR 62034. In conjunction with the NOPR, DOE also published on its website the complete TSD for the proposed rule, which incorporated the analyses DOE conducted and technical documentation of each analysis, as well as the LCC and NIA spreadsheets. These documents are available at www.eere.energy.gov/buildings/appliance_standards/. For the reasons discussed above in section 1.2, DOE did not consider energy conservation standards for dishwashers and dehumidifiers, and is instead codifying in a separate final rule the standards set by EISA 2007 for these products. The energy conservation standards proposed in the NOPR for the remaining covered products were as follows:

Table 1.3.2 Proposed Energy Conservation Standards for Cooking Products and Commercial Clothes Washers

Product Class	Proposed Energy Conservation Standards
Conventional Cooking Products	
Gas cooktops/conventional burners	No constant burning pilot lights
Electric cooktops/low or high wattage open (coil) elements	No standard
Electric cooktops/smooth elements	No standard
Gas ovens/standard oven	No constant burning pilot lights
Gas ovens/self-clean oven	No change to existing standard
Electric ovens	No standard
Microwave ovens	Maximum standby power = 1.0 watt
Commercial clothes washers	
Top-loading commercial clothes washers	1.76 Modified Energy Factor / 8.3 Water Factor
Front-loading commercial clothes washers	2.00 Modified Energy Factor / 5.5 Water Factor

The NOPR also included additional background information on the history of this rulemaking and on DOE's use in this rulemaking of the procedures, interpretations, and policies set forth in the Process Rule. 73 FR 62034, 62038–41 (Oct. 17, 2008). DOE held a public meeting on November 13, 2008, to hear oral comments on and solicit information relevant to the proposed rule.

Based on information provided by interested parties at the public meeting and in subsequent written comments, DOE determined that additional analyses would be required to

further evaluate energy conservation standards for commercial clothes washers and microwave ovens as to standby power. The EISA 2007 amendments to EPCA require DOE to amend the ranges and ovens and microwave oven test procedure to incorporate standby and off mode energy consumption no later than March 31, 2011. (42 U.S.C. 6295(gg)(2)(B)(vi)) For commercial clothes washers, EPCA requires that DOE issue a final rule by January 1, 2010, to determine whether the existing energy conservation standards should be amended. (42 U.S.C. 6313(e)(2)(A)) Because additional analyses are required to resolve issues concerning commercial clothes washer and microwave oven standby power energy conservation standards and EPCA does not require DOE to take action on these products by March 2009 (as is required under a Consent Decree[c] for the cooking efficiency for residential electric and gas kitchen ranges and ovens and microwave ovens), DOE is continuing the rulemaking for these products at this time.

According to the rulemaking timeline, DOE plans to issue a final rule for energy conservation standards pertaining to cooking efficiency for residential electric and gas kitchen ranges and ovens and microwave ovens in March 2009. The effective date for these new standards would be in March 2012. Separate final rules for commercial clothes washers and microwave ovens pertaining to standby power are planned to be issued as soon as the revised analyses are complete.

1.4 STRUCTURE OF THE DOCUMENT

This final rule TSD outlines the analytical approaches used in this rulemaking. The TSD consists of seventeen chapters and appendices.

Chapter 1	Introduction: provides an overview of the appliance standards program and how it applies to this rulemaking, and outlines the structure of the document.
Chapter 2	Analytical Framework: describes the rulemaking process.
Chapter 3	Market and Technology Assessment: characterizes the market for the considered products and the technologies available for increasing product efficiency.
Chapter 4	Screening Analysis: determines which design options are viable for consideration in the engineering analysis.

[c] "Consent Decree" refers to the consolidated Consent Decree in New York v. Bodman, No. 05 Civ. 7807 (S.D.N.Y. filed Sept. 7, 2005) and Natural Resources Defense Council v. Bodman, No. 05 Civ. 7808 (S.D.N.Y. filed Sept. 7, 2005)

Chapter 5	Engineering Analysis: discusses the methods used for developing the relationship between increased manufacturer cost and increased efficiency.
Chapter 6	Energy and Water Use Determination: discusses the process used for generating energy- and water-use estimates for the considered products as a function of standard levels.
Chapter 7	Markups for Equipment Price Determination: discusses the methods used for establishing markups for converting manufacturer costs to customer retail prices.
Chapter 8	Life-Cycle Cost and Payback Period Analysis: discusses the effects of standards on individual customers and users of the products and compares the LCC and PBP of products with and without higher energy conservation standards.
Chapter 9	Trial Standard Levels: discusses the trial standard levels and methods used to derive the energy-efficiency equations corresponding to the proposed energy conservation standards.
Chapter 10	Shipments Analysis: discusses the methods used for forecasting shipments with and without higher efficiency standards, including how equipment purchase decisions are economically influenced and how DOE models this relationship with econometric equations.
Chapter 11	National Impact Analysis: discusses the methods used for forecasting national energy consumption and national economic impacts based on estimates of future equipment efficiency, new construction and building starts, and annual equipment sales in the absence and presence of higher efficiency standards.
Chapter 12	Life-Cycle Cost Subgroup Analysis: discusses the effects of standards on different subgroups of consumers and compares the LCC and PBP of products with and without higher efficiency standards for these consumers.
Chapter 13	Manufacturer Impact Analysis: discusses the financial impact of new energy conservation standards on manufacturers.
Chapter 14	Utility Impact Analysis: discusses the effects of standards on electric and gas utilities.
Chapter 15	Employment Impact Analysis: discusses the effects of standards on national employment.

Chapter 16	Environmental Assessment: discusses the effects of amended energy conservation standards on three pollutants—sulfur dioxide (SO_2), nitrogen oxides (NO_x), and mercury—as well as carbon emissions.
Chapter 17	Regulatory Impact Analysis: discusses the present regulatory actions as well as the impact of non-regulatory alternatives to setting new energy conservation standards.
Appendix 5A	AHAM Data Submittal: presents the data provided by AHAM to DOE for microwave ovens.
Appendix 6A	Cooktops and Ovens: Determination of Energy-Using Components: discusses the method for determining the energy use by energy-using components of cooktops and ovens including cooking, ignition, self-cleaning, and clock energy.
Appendix 8A	User Instructions for LCC and PBP Spreadsheets: briefly describes the LCC and PBP spreadsheets for each of the considered products and provides brief user instructions on how to operate the spreadsheets.
Appendix 8B	Uncertainty and Variability: discusses how DOE uses uncertainty and variability to characterize the inputs to the LCC and PBP analysis.
Appendix 8C	Lifetime Distributions: discusses how product lifetimes are characterized with Weibull probability distributions.
Appendix 8D	Household Discount Rate Distributions: provides the probability distributions for various household debt classes and asset holdings used to develop discount rates for household appliances in the LCC analysis.
Appendix 10A	Relative Price Elasticity of Demand for Appliances: describes the analysis that DOE conducted to determine the consumer sensitivity to appliance purchase price changes as well as operating cost changes and household income.
Appendix 11A	User Instructions for Shipments and NIA Spreadsheets: briefly describes the shipments and national impact analysis (NIA) spreadsheets for each of the considered products and provides brief user instructions on how to operate the spreadsheets.
Appendix 11B	National Equipment and Operating Costs: provides the components to the NPV for each of the considered products, namely, the present value of the equipment costs and the present value of the operating costs.

Appendix 13A Manufacturer Interview Guides: presents questionnaires used to guide DOE interviews with residential cooking product manufacturers.

Appendix 13B Government Regulatory Impact Model (GRIM): discusses the method to estimate the change in value of an industry or manufacturers(s) following a regulation or a series of regulations.

Appendix 14A Interpolation of Utility and Environmental Results from NEMS-BT Output: describes the methodology for using output from NEMS-BT to estimate the utility impact and environmental impact results for product standards.

Appendix 17A Regulatory Impact Analysis Supporting Material: provides more detailed information on the data used to conduct the Regulatory Impact Analysis.